

AMENDMENTS TO THE CLAIMS

Claims 1-19 (Withdrawn)

20. (Currently Amended) A microelectromechanical system comprising:
a substrate;
a platform including first, second and third attachment points, said platform being pivotably attached to said substrate at the first attachment point;
a first lever arm attached to said platform at the second attachment point of said platform and pivotably attached to said substrate at a first anchor point on said substrate; and
a second lever arm attached to said platform at the third attachment point of said platform and pivotably attached to said substrate at a second anchor point on said substrate;
said first attachment point being located on the same side of a line intersecting said second and third attachment points as a side of said line on which said first and second anchor points are located when said platform is in a non-tilted orientation with respect to said substrate;
said first and second lever arms being separately pivotable about said first and second anchor points, respectively, by unequal angular amounts to tilt said platform with respect to said substrate with at least two degrees of freedom, wherein each of said first and second lever arms are pivotable in response to an actuation force mechanically coupled thereto and generated without utilizing any portion of said lever arms and said platform.

21. (Original) The system of Claim 20 further comprising:
a first actuator microstructure formed on said substrate, said first actuator microstructure being coupled to said first lever arm and operable to effect pivoting of said first lever arm with respect to said substrate; and
a second actuator microstructure formed on said substrate, said second actuator microstructure being coupled to said second lever arm and operable to effect pivoting of said second lever arm with respect to said substrate.

22. (Original) The system of Claim 21 wherein said first and second actuator

microstructures are separately operable without external feedback control to effect pivoting of said first and second lever arms, respectively, with respect to said substrate such that said platform is inclinable in a first direction with respect to said substrate at any angle within a first specified range of angles and inclinable in a second direction with respect to said substrate at any angle within a second specified range of angles.

23. (Original) The system of Claim 22 wherein the first specified range of angles is between 0 and 60 degrees and said second range of angles is between -45 and +45 degrees.

24. (Original) The system of Claim 22 wherein said first and second actuator microstructures comprise electrostatic actuators operable in response to control voltages applied across terminals thereof.

25. (Original) The system of Claim 23 wherein said platform is tiltable with respect to said substrate with one degree of freedom by applying the same level control voltage across terminals of said first and second actuator microstructures.

26. (Original) The system of Claim 21 further comprising:
a first tether coupling a laterally moveable output of said first actuator microstructure to said first lever arm; and
a second tether coupling a laterally moveable output of said second actuator microstructure to said second lever arm.

27. (Currently Amended) The system of Claim 2426 wherein said first and second actuator microstructures are respectively comprised of first and second groups of separate actuators having separate laterally moveable outputs, and said system further comprises:

a first yoke joining said laterally moveable outputs of said first group of actuators together for connection with said first tether; and
a second yoke joining said laterally moveable outputs of said second group of actuators together for connection with said second tether.

28. (Original) The system of Claim 27 further comprising:
a first displacement multiplier coupling said first tether to said first yoke; and
a second displacement multiplier coupling said second tether to said second yoke.

29. (Original) The system of Claim 20 wherein said substrate comprises silicon.

30. (Original) The system of Claim 20 wherein said platform comprises one of monocrystalline and polycrystalline silicon.

31. (Original) The system of Claim 20 wherein said platform includes at least one of an optically reflective surface, a diffraction grating, a lens, and an optical polarizer.

32. (Original) The system of Claim 20 further comprising:
a first compliant member attaching said platform to said substrate at the first attachment point;
a second compliant member attaching said first lever arm to said platform at the second attachment point; and
a third compliant member attaching said second lever arm to said platform at the third attachment point.

33. (Original) The system of Claim 32 wherein said first, second and third compliant members comprise springs.

34. (Original) The system of Claim 20 wherein said first and second lever arms have different lengths measured between where each said lever arm is attached to said substrate and to said platform.

Claims 35-51 (Withdrawn)

52. (Currently Amended) A microelectromechanical system comprising:
a substrate;

a platform;

a first lever arm attached to said platform by at least one compliant member and pivotably attached to said substrate at a first anchor point on said substrate; and

a second lever arm attached to said platform by at least one compliant member and pivotably attached to said substrate at a second anchor point on said substrate;

said first and second lever arms being pivotable about said first and second anchor points, respectively, in at least a first direction by equal angular amounts to tilt said platform with one degree of freedom in at least the first direction;

said first and second lever arms being pivotable about said first and second anchor points, respectively, in at least a first direction by unequal angular amounts to tilt said platform with respect to said substrate with at least two degrees of freedom; and

wherein each of said first and second lever arms are pivotable in response to an actuation force mechanically coupled thereto and generated without utilizing any portion of said lever arms and said platform.

53. (Original) The system of Claim 52 further comprising:

a first actuator microstructure formed on said substrate, said first actuator microstructure being coupled to said first lever arm and operable to effect pivoting of said first lever arm with respect to said substrate; and

a second actuator microstructure formed on said substrate, said second actuator microstructure being coupled to said second lever arm and operable to effect pivoting of said second lever arm with respect to said substrate.

54. (Original) The system of Claim 53 wherein said first and second actuator microstructures are separately operable without external feedback control to effect pivoting of said first and second lever arms, respectively, with respect to said substrate such that said platform is inclinable in a first direction with respect to said substrate at any angle within a first specified range of angles and inclinable in a second direction with respect to said substrate at any angle within a second specified range of angles.

55. (Original) The system of Claim 54 wherein the first specified range of angles is

between 0 and 60 degrees and said second range of angles is between -45 and +45 degrees.

56. (Original) The system of Claim 53 wherein said first and second actuator microstructures comprise electrostatic actuators operable in response to control voltages applied across terminals thereof.

57. (Original) The system of Claim 56 wherein said platform is tiltable with respect to said substrate with one degree of freedom by applying the same level control voltage across terminals of said first and second actuator microstructures.

58. (Currently Amended) The system of Claim 52 further comprising:
a first tether coupling a laterally moveable output of said first actuator microstructure to said first lever arm; and
a second tether coupling a laterally moveable output of said second actuator microstructure to said second lever arm.

59. (Currently Amended) The system of Claim 54 wherein said first and second actuator microstructures are respectively comprised of first and second groups of separate actuators having separate laterally moveable outputs, and said system further comprises:

a first yoke joining said laterally moveable outputs of said first group of actuators together for connection with said first tether; and
a second yoke joining said laterally moveable outputs of said second group of actuators together for connection with said second tether.

60. (Original) The system of Claim 59 further comprising:
a first displacement multiplier coupling said first tether to said first yoke; and
a second displacement multiplier coupling said second tether to said second yoke.

61. (Original) The system of Claim 52 wherein said substrate comprises silicon.

62. (Original) The system of Claim 52 wherein said platform comprises one of

monocrystalline and polycrystalline silicon.

63. (Original) The system of Claim 52 wherein said platform includes at least one of an optically reflective surface, a diffraction grating, a lens, and an optical polarizer.

64. (Original) The system of Claim 52 wherein said compliant members comprise springs.

65. (Original) The system of Claim 52 wherein said first and second lever arms have different lengths measured between where each said lever arm is attached to said substrate and to said platform.

66. (New) A microelectromechanical system comprising:

a substrate;

a platform including first, second and third attachment points, said platform being pivotably attached to said substrate at the first attachment point;

a first lever arm attached to said platform at the second attachment point of said platform and pivotably attached to said substrate at a first anchor point on said substrate;

a second lever arm attached to said platform at the third attachment point of said platform and pivotably attached to said substrate at a second anchor point on said substrate;

a first actuator microstructure formed on said substrate, said first actuator microstructure being coupled to said first lever arm and operable to effect pivoting of said first lever arm with respect to said substrate;

a second actuator microstructure formed on said substrate, said second actuator microstructure being coupled to said second lever arm and operable to effect pivoting of said second lever arm with respect to said substrate;

a first tether coupling a laterally moveable output of said first actuator microstructure to said first lever arm; and

a second tether coupling a laterally moveable output of said second actuator microstructure to said second lever arm;

said first attachment point being located on the same side of a line intersecting said second

and third attachment points as a side of said line on which said first and second anchor points are located when said platform is in a non-tilted orientation with respect to said substrate;

said first and second lever arms being separately pivotable about said first and second anchor points, respectively, by unequal angular amounts to tilt said platform with respect to said substrate with at least two degrees of freedom.

67. (New) The system of Claim 66 wherein said first and second actuator microstructures are respectively comprised of first and second groups of separate actuators having separate laterally moveable outputs, and said system further comprises:

a first yoke joining said laterally moveable outputs of said first group of actuators together for connection with said first tether; and

a second yoke joining said laterally moveable outputs of said second group of actuators together for connection with said second tether.

68. (New) The system of Claim 67 further comprising:

a first displacement multiplier coupling said first tether to said first yoke; and

a second displacement multiplier coupling said second tether to said second yoke.

69. (New) A microelectromechanical system comprising:

a substrate;

a platform including first, second and third attachment points, said platform being pivotably attached to said substrate at the first attachment point;

a first lever arm attached to said platform at the second attachment point of said platform and pivotably attached to said substrate at a first anchor point on said substrate; and

a second lever arm attached to said platform at the third attachment point of said platform and pivotably attached to said substrate at a second anchor point on said substrate;

said first attachment point being located on the same side of a line intersecting said second and third attachment points as a side of said line on which said first and second anchor points are located when said platform is in a non-tilted orientation with respect to said substrate;

said first and second lever arms being separately pivotable about said first and second anchor points, respectively, by unequal angular amounts to tilt said platform with respect to said substrate with at least two degrees of freedom; and

wherein said first and second lever arms have different lengths measured between where each said lever arm is attached to said substrate and to said platform.

70. (New) A microelectromechanical system comprising:

a substrate;

a platform;

a first lever arm attached to said platform by at least one compliant member and pivotably attached to said substrate at a first anchor point on said substrate;

a second lever arm attached to said platform by at least one compliant member and pivotably attached to said substrate at a second anchor point on said substrate;

a first actuator microstructure formed on said substrate, said first actuator microstructure being coupled to said first lever arm and operable to effect pivoting of said first lever arm with respect to said substrate;

a second actuator microstructure formed on said substrate, said second actuator microstructure being coupled to said second lever arm and operable to effect pivoting of said second lever arm with respect to said substrate;

a first tether coupling a laterally moveable output of said first actuator microstructure to said first lever arm; and

a second tether coupling a laterally moveable output of said second actuator microstructure to said second lever arm;

said first and second lever arms being pivotable about said first and second anchor points, respectively, in at least a first direction by equal angular amounts to tilt said platform with one degree of freedom in at least the first direction;

said first and second lever arms being pivotable about said first and second anchor points, respectively, in at least a first direction by unequal angular amounts to tilt said platform with respect to said substrate with at least two degrees of freedom.

71. (New) The system of Claim 70 wherein said first and second actuator microstructures

are respectively comprised of first and second groups of separate actuators having separate laterally moveable outputs, and said system further comprises:

a first yoke joining said laterally moveable outputs of said first group of actuators together for connection with said first tether; and

a second yoke joining said laterally moveable outputs of said second group of actuators together for connection with said second tether.

72. (New) The system of Claim 71 further comprising:

a first displacement multiplier coupling said first tether to said first yoke; and

a second displacement multiplier coupling said second tether to said second yoke.

73. (New) A microelectromechanical system comprising:

a substrate;

a platform;

a first lever arm attached to said platform by at least one compliant member and pivotably attached to said substrate at a first anchor point on said substrate; and

a second lever arm attached to said platform by at least one compliant member and pivotably attached to said substrate at a second anchor point on said substrate;

said first and second lever arms being pivotable about said first and second anchor points, respectively, in at least a first direction by equal angular amounts to tilt said platform with one degree of freedom in at least the first direction;

said first and second lever arms being pivotable about said first and second anchor points, respectively, in at least a first direction by unequal angular amounts to tilt said platform with respect to said substrate with at least two degrees of freedom; and

wherein said first and second lever arms have different lengths measured between where each said lever arm is attached to said substrate and to said platform.